REMARKS

In this office action the Examiner rejected claims 1-7,9,11-12,14-15,18-19 under 35 U.S.C. 103(a) as being unpatentable over Oudet et al. (U.S. Pat. No 5, 559, 378) in view of Fiegel et al. (U.S. Pat. No. 5, 826, 952) and further in view of Noltner (DE 2355728A). To support the rejection the Examiner stated,

"Oudet et al. substantially teach the claimed invention except that it does not show an electric power generator comprising an O-ring in a groove formed on the outer surface of the first portion of the piston to prevent loss of air between the piston and the cylinder. Oudet et al. do not disclose that an emf is generated in the electric coil, so that an external circuit connected to the electric coil receives electric power from the electric coil. Oudet et al. do not disclose that the inlet flow path includes an air filter to exclude foreign material from the cylinder. Oudet et al. do not disclose that the inlet flow path includes a choke to control an impedance of the inlet flow path.

Oudet et al. do not disclose that the cylinder extension have an inner surface having a transverse dimension greater than a transverse dimension of the cylinder. Oudet et al. do not disclose that at least a portion of the piston extension contacts at least a portion of the cylinder extension to provide positional constraint to the piston. Oudet et al. do not disclose that the portion of the piston extension contacting at least a portion of the cylinder extension is an outer surface of

the piston extension and the portion of the cylinder extension is an inner surface of the cylinder extension. Oudet et al. do not disclose that the piston extension has at least one longitudinal air passage to carry air to an end of the piston adjacent the end closure, the exhaust being connected to the end closure. Oudet et al. do not disclose that the exhaust passage includes an electrically actuated shutoff valve to prevent air flow through the generator, thereby turning off the generator.

Fiegel et al. disclose sealing means (an O-ring in a groove formed on the outer surface of the first portion of the piston according to 35 U.S.C. 112, Sixth Paragraph) disposed on at least one of an outer surface of the first portion of the piston (22) and an inner surface of the cylinder to prevent loss of fluid between the piston (22) and the cylinder and permit fluid pressure in the cylinder to increase when the first portion of the piston (22) is disposed within the cylinder. Fiegel et al. disclose that the sealing means is an O-ring in a groove formed on the outer surface of the first portion of the piston (22). Fiegel et al. disclose that the inlet flowpath includes a fluid filter (62) for excluding foreign material from the cylinder. Fiegel et al. disclose that the cylinder extension having an inner surface having a transverse dimension greater than a transverse dimension of the cylinder.

Fiegel et al. disclose that at least a portion of the piston extension (37 in figure 3) contacting at least a portion of the cylinder extension to provide positional constraint to the piston

(22). Fiegel et al. disclose that the portion of the piston extension (63 in figure 4) contacting at least a portion of the cylinder extension is an outer surface of the piston extension (63) and the portion of the cylinder extension is an inner surface of the cylinder extension. Fiegel et al. disclose that the piston extension (37) has at least one longitudinal fluid passage (65) to carry fluid to an end of the piston (22) adjacent the end closure (32,35), the exhaust (35) being connected to the end closure (32). Fiegel et al. disclose that the passage (65) includes an electrically actuated shutoff valve (46-49) to prevent fluid flow through the actuator, thereby turning off the actuator. The invention of Fiegel et al. has the purpose of increasing efficiency and reducing the dimensions and weight of the embodiment.

Noltner disclose an electric power generator whereby an emf is generated in the electric coil (5), so that an external circuit connected to the electric coil (5) receives electric power from the electric coil (5). Noltner disclose that the inlet flowpath includes a choke (10,11) to control an impedance of the inlet flowpath. Noltner's invention has the purpose of showing that the electromagnetic piston-cylinder configuration can be applied in pumps, compressors, and generators which can be either hydraulically, pneumatically or thermally actuated.

It would have been obvious at the time the invention was made to modify the embodiment of Oudet et al. and provide it with the sealing means, filter, cylinder and piston configurations,

longitudinal fluid passage, electrically actuated shutoff valves, and operate the embodiment as a generator as disclosed by Fiegel et al. and Noltner for the purpose of increasing efficiency and reducing the dimensions and weight of the embodiment and provide the specified electric power source configuration.

The examiner takes Official Notice of the reversibility of electric generators and electric motors in the dynamoelectric art and the selection of any of these known embodiments to provide either electric power or mechanical force, respectively would be within the level of ordinary skill in the art. (Electric Motors and Motor Controls; Jeff Keljik; 1995; Delmar Publishers; pages 139-142)"

Applicant has amended claim 1 to further define that the present invention only has a single piston, a single cylinder and a single biasing means. These changes are clearly described in the specification and are quite evident in the drawings.

The invention of Oudet et al. provides dual cylinders that are defined by such lateral stator poles 70,71. The mobile device 50 of Oudet et al. is positioned either in first cylinder delimited by lateral pole 70 or in second cylinder defined by lateral pole 71. Pressurized fluid enters from either input 80 or 82 and exhausts via gaps 91 and 93 or gaps 90 and 92 to pressure outlets 81 and 83, respectively. Springs (biasing means) 51 and 52 are positioned on either end of the mobile device 50. As Oudet et al. states, "Springs 51, 52 ensure the positioning of the mobile device in a position in which the junction 53 between

the two ring shaped magnets 10 and 11 corresponds to the middle of the central pole 54." The teaching of Oudet et al., thus, provides for two springs or biasing means positioned on either end of the mobile device 50 which includes what the Examiner refers to as piston 56. Oudet et al. refers to 56 as a central hub. The teaching further includes what is essentially two mirror image cylinders each having their own separate inlets and outlets. There is never any transfer of fluid from the first cylinder to the second cylinder. When the mobile device is moved sufficiently from the first cylinder, pressurized fluid exhausts through gaps 91 and 93. Then second spring 51 and pressurized fluid from input 82 forces the mobile device away from the second cylinder until the pressurized fluid is exhausted through gaps 90 and 92. The mobile device in the first cylinder is returned by means of first spring 52 and pressurized fluid from input 80. Thus, the teaching of Oudet et al. requires the use of two sets of springs, two pressurized fluid inlets and at least two exhaust ports (Oudet et al. has four exhaust ports) and as constructed will not operate properly with only one biasing means and one pressurized inlet.

The present invention, on the other hand, as defined in amended claim 1, has one biasing means which is not positioned in the first cylinder. The present invention provides, "a single biasing means for moving said piston from said second position toward said first position so that after said cylinder has substantially exhausted, said piston moves to said first

position, whereby said piston oscillates, moving back and forth between said first position and said second position, driven alternately by air supplied through such air supply passage to said cylinder and by said biasing means;".

The present invention, further, has only one cylinder with a first end connectable through an inlet flow path to an air supply passage. The teaching of Oudet et al. requires two inlet flow paths, one on each end of the device; a first inlet connectable to a first cylinder and the second inlet connectable to the second cylinder. The present invention provides for only one inlet flow path which is connectable to a first end of the cylinder.

Since there are significant differences between the teaching of Oudet et al. and the present invention, Applicant respectfully requests that the Examiner withdraw the rejection of claims 1-7,9,11-12,14-15,18-19 under 35 U.S.C. 103(a) as being unpatentable over Oudet et al. (U.S. Pat. No 5, 559, 378) in view of Fiegel et al. (U.S. Pat. No. 5, 826, 952) and further in view of Noltner (DE 2355728A).

The Examiner rejected claim 8 under 35 U.S.C. 103(a) as being unpatentable over Oudet et al. in view of Fiegel et al. and further in view of Noltner as applied to claim 7 above, and further in view of Higham et al. (U. S. Pat. 5,146,124). The Examiner stated,

"Oudet et al., Fiegel et al. and Noltner substantially teaches the claimed invention except that it does not show that

at least one of the outer surface of the piston extension and the inner surface of the cylinder extension is at least one of made from and coated with a low friction material.

Higham et al. disclose that at least one of the outer surface of the piston extension (10) and the inner surface of the cylinder extension (560) is at least one of made from and coated with a low friction material (532). The invention of Higham et al. has the purpose of reducing wear and friction of the contacting surfaces.

It would have been obvious at the time the invention was made to modify the embodiment of Oudet et al., Fiegel et al. and Noltner and provide it with the low friction material disclosed by Higham et al. for the purpose of reducing wear and friction of the contacting surfaces."

Since claim 8 is dependent on claim 1 and since claim 1 is clearly different from the teaching of Oudet et al., Applicant respectfully requests that the Examiner withdraw the rejection of claim 8 under 35 U.S.C. 103(a) as being unpatentable over Oudet et al. in view of Fiegel et al. and further in view of Noltner as applied to claim 7 above, and further in view of Higham et al. (U. S. Pat. 5,146,124).

Further in the office action the Examiner rejected claim 10 under 35 U.S.C. 103(a) as being unpatentable over Oudet et al. in view of Fiegel et al. and further in view of Noltner as applied to claim 9 above, and further in view of Meyer (U. S. Pat. 4,352,645). The Examiner stated,

"Oudet et al., Fiegel et al. and Noltner substantially teaches the claimed invention except that it does not show that the at least one longitudinal air passage is a longitudinal slot formed in the outer surface of the piston extension.

Meyer discloses that the at least one longitudinal fluid passage (31) is a longitudinal slot formed in the outer surface of the piston extension (19). Meyer's invention has the purpose of providing a fluid discharge between two chambers of the embodiment.

It would have been obvious at the time the invention was made to modify the embodiment of Oudet et al., Fiegel et al. and Noltner and provide it with the longitudinal slot disclosed by Meyer for the purpose of providing a fluid discharge between two chambers of the embodiment."

Since claim 10 is dependent on claim 1 and since claim 1 is clearly different from the teaching of Oudet et al., Applicant respectfully requests that the Examiner withdraw the rejection of claim 10 under 35 U.S.C. 103(a) as being unpatentable over Oudet et al. in view of Fiegel et al. and further in view of Noltner as applied to claim 9 above, and further in view of Meyer (U. S. Pat. 4,352,645).

The Examiner then rejected claim 13 under 35 U.S.C. 103(a) as being unpatentable over Oudet et al. in view of Fiegel et al. and further in view of Noltner as applied to claim 5 above, and further in view of Park (U. S. Pat. 5,451,727). The Examiner stated,

"Oudet et al., Fiegel et al. and Noltner substantially teaches the claimed invention except that it does not show that the exhaust passage includes a muffler to reduce noise released from the generator.

Park discloses that the exhaust passage includes a muffler (31) to reduce noise released from the actuator. Park's invention has the purpose of diminishing noise and heat transfer thus improving the performance of the embodiment.

It would have been obvious at the time the invention was made to modify the embodiment of Oudet et al., Fiegel et al. and Noltner and provide it with the muffler disclosed by Park for the purpose of diminishing noise and heat transfer thus improving the performance of the embodiment."

Since claim 13 is dependent on claim 1 and since claim 1 is clearly different from the teaching of Oudet et al., Applicant respectfully requests that the Examiner withdraw the rejection of claim 13 under 35 U.S.C. 103(a) as being unpatentable over Oudet et al. in view of Fiegel et al. and further in view of Noltner as applied to claim 5 above, and further in view of Park (U. S. Pat. 5,451,727).

The Examiner rejected claims 16-17 under 35 U.S.C. 103(a) as being unpatentable over Oudet et al. in view of Fiegel et al. and further in view of Noltner as applied to claim 1 above, and further in view of Konotchick (U. S. Pat. 5,347,186). The Examiner stated,

"Oudet et al., Fiegel et al. and Noltner substantially teaches the claimed invention except that it does not show that the at least one electric coil is connected to a rectifier to supply DC electric power. Neither Oudet et al., Fiegel et al. nor Noltner disclose that the rectifier is a full bridge rectifier to supply DC electric power whenever a net flux through the at least one electric coil is changing.

Konotchick discloses that the at least one electric coil (70-73) is connected to a rectifier (figure 5b) to supply DC electric power. Konotchick discloses that the rectifier is a full bridge rectifier to supply DC electric power whenever a net flux through the at least one electric coil is changing. Konotchick's invention has the purpose of providing electrical regulation and the capability to handle small power surges.

It would have been obvious at the time the invention was made to modify the embodiment of Oudet et al., Fiegel et al. and Noltner and provide it with the rectifier disclosed by Konotchick for the purpose of providing electrical regulation and the capability to handle small power surges."

Since claims 16-17 are dependent on claim 1 and since claim 1 is clearly different from the teaching of Oudet et al., Applicant respectfully requests that the Examiner withdraw the rejection of claims 16-17 under 35 U.S.C. 103(a) as being unpatentable over Oudet et al. in view of Fiegel et al. and further in view of Noltner as applied to claim 1 above, and further in view of Konotchick (U. S. Pat. 5,347,186).

Further, the Examiner rejected claims 20-21 under 35 U.S.C. 103(a) as being unpatentable over Oudet et al. in view of Noltner. The Examiner stated,

"Oudet et al. substantially teaches the claimed invention except that it does not show an electric power generator whereby an emf is generated in the electric coil, so that an external circuit connected to the electric coil receives electric power from the electric coil.

Noltner disclose an electric power generator whereby an emf is generated in the electric coil, so that an external circuit connected to the electric coil receives electric power from the electric coil. Noltner's invention has the purpose of showing that the electromagnetic piston-cylinder configuration can be applied in pumps, compressors, and generators which can be either hydraulically, pneumatically or thermally actuated.

It would have been obvious at the time the invention was made to modify the embodiment of Oudet et al., and Noltner and provide it with the capability of operating the embodiment as a generator as disclosed by Noltner for the purpose of providing the electromagnetic piston-cylinder configuration application in generators which can be either hydraulically, pneumatically or thermally actuated."

Applicant has amended claim 20 to further define that the present invention has only a single piston, has two cylinder extensions, a means for connecting the cylinder extensions and has a common exhaust for the first and second cylinders. The

teaching of Oudet et al. provides for a separate exhaust for each cylinder. Also the operation of the apparatus of Oudet et al. requires two biasing means (springs), one spring disposed in each cylinder. In the present invention the cylinder moves to a second position from a first position because of pressure building up on the first end of the cylinder, once the cylinder has moved to the second position the first cylinder exhausts through the common exhaust and pressure builds in the second cylinder forcing the cylinder back to the first position and the second cylinder exhausts through the common exhaust and the system repeats itself. The present invention only utilizes a spring to facilitate starting in the event the piston is not in the first position. The apparatus of Oudet et al. requires the two biasing means to force the cylinder to the different positions.

Amended claim 20 also defines separate cylinder extensions, there is a first cylinder extension 68 for the first cylinder 62 and a second cylinder extension 76 for second cylinder 70 and a means 78 for connecting these cylinder extensions together. There is no teaching in Oudet et al. about any cylinder extensions nor is there any teaching about a means for connecting the extensions.

Since there are significant differences between the teaching of Oudet et al. and the present invention Applicant respectfully requests that the Examiner withdraw the rejection of claims 20-21

under 35 U.S.C. 103(a) as being unpatentable over Oudet et al. in view of Noltner.

In view of the discussion supra, it is believed that the invention as described in claims 1-20 is patentable and that this application is now in condition for allowance and such allowance by the Examiner is respectfully requested.

In the event the Examiner has further difficulties with the examination and/or allowance of the application, she is invited to contact the undersigned agent for applicant by telephone at (412) 380-0725, if necessary, to resolve any remaining questions or issues by interview and/or Examiner's Amendment as to any matter.

Respectfully submitted,
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Appendix A

In the specification:

On page 10, after line 16, please enter the following:

--As is clearly evident in both Figures 8 and 9 that exhaust 98 is a common exhaust for both cylinders. So that when first end portion 82 of piston 80 is forced out of first cylinder 62, the second end portion 86 of piston 80 enters second cylinder 70, as shown in Figure 9. In this position pressurized air from such first cylinder 62 is exhausted through exhaust 98. Pressurized air from the second inlet flowpath 92 from passage 61 then increases the pressure in the second cylinder 70 and forces piston 80 so that first end portion 82 moves back into the first cylinder 62, as shown in Figure 8. Pressurized air from the second cylinder 70 is now exhausted through exhaust 98.--

In the claims:

1. (Amended) A pneumatically driven electric power generator comprising:

a single cylinder having a first end connectable through [an] a single inlet flowpath to an air supply passage containing air at a positive pressure, a second end of said cylinder being open;

a cylinder extension at least one of formed integrally with and attached to said single cylinder, said cylinder extension having an inner surface having a transverse dimension greater than a transverse dimension of said single cylinder, said cylinder extension including a threaded portion adjacent one end thereof;

an end closure threadably connected to an end of said cylinder extension;

a single piston having a magnetic moment associated therewith, said piston being positionable in a first location wherein at least a first portion of said piston is disposed within said cylinder and in a second location wherein said first portion of said single piston is outside of said single cylinder so that clearance is provided between said single cylinder so that air may exhaust from said single cylinder;

sealing means disposed on at least one of an outer surface of said first portion of said single piston and an inner surface of said single cylinder to prevent loss of air between said single piston and said single cylinder and permit air pressure in

said single cylinder to increase when said first portion of said single piston is disposed within said single cylinder;

[said piston also being positionable in a second location wherein said first portion of said piston is outside of said cylinder so that clearance is provided between said piston and said cylinder so that air may exhaust from said cylinder;]

a single biasing means caged between a ledge portion adjacent one end of said single piston and an inner surface of said end closure for moving [means engaging said piston for biasing] said single piston from said second position toward said first position so that after said single cylinder has substantially exhausted, said single piston moves to said first position, whereby said single piston oscillates, moving back and forth between said first position and said second position, driven alternately by air supplied through such air supply passage to said single cylinder and by said biasing means; and

at least one electric coil placed to enclose changing magnetic flux caused by said magnetic moment associated with said piston whereby an emf is generated in said electric coil, so that an external circuit connected to said electric coil receives electric power from said electric coil.

5. (Amended) A pneumatically driven electric power generator according to claim 1 wherein said generator further includes[:

a cylinder extension at least one of formed integrally with and attached to said cylinder, said cylinder extension

having an inner surface having a transverse dimension greater than a transverse dimension of said cylinder; and]

an exhaust passage connected to at least one of said cylinder extension and said end closure.

11. (Amended) A pneumatically driven electric power generator according to claim 1 wherein said biasing means [disposed on said pneumatically driven electric power generator for biasing said single piston from said second position to said first position] is a spring.

12. (Amended) A pneumatically driven electric power generator according to claim [1] 11 wherein said spring is a compression spring disposed between said piston extension and said end closure.

20. (Amended) A pneumatically driven electric power generator comprising:

a first cylinder having a first end connectable through a first inlet flowpath to an air supply passage, a second end of said first cylinder being open;

a first cylinder extension at least one of formed integrally with and attached to said first cylinder, said first cylinder extension having an inner surface having a transverse dimension greater than a transverse dimension of said first cylinder;

a second cylinder having a first end connectable through a

second inlet flowpath to said air supply passage, a second end of said second cylinder being open;

a second cylinder extension at least one of formed integrally with and attached to said second cylinder, said second cylinder extension having an inner surface having a transverse dimension greater than a transverse dimension of said second cylinder;

a means for connecting said first cylinder extension and said second cylinder extension;

a common exhaust for said first cylinder and said second cylinder;

a single piston having a magnetic moment associated therewith, said single piston having a first end portion and a second end portion, said single piston being positionable in a first location wherein said first end portion of said single piston is disposed within said first cylinder and said second end portion of said single piston is disposed outside of said second cylinder, said single piston further being positionable in a second location wherein said second end portion of said single piston is disposed within said second cylinder and said first portion of said single piston is outside of said first cylinder;

so that when said single piston is disposed in said first position, air pressure received in said first cylinder through said first inlet flowpath drives said single piston toward said second position, whereupon said first cylinder exhausts, and when said single piston is disposed in said second position, air

pressure received in said second cylinder through said second inlet flowpath drives said single piston toward said first position, whereupon said second cylinder exhausts, so that said single piston oscillates; and

at least one electric coil placed to enclose changing magnetic flux caused by said magnetic moment associated with said piston whereby an emf is generated in said electric coil, so that an external circuit connected to said electric coil receives electric power from said electric coil.